AFRL-RX-TY-TP-2009-4560

PREPRINT

AIRFIELD DAMAGE REPAIR – THE FUTURE NOW

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AUGUST 2009

This document was submitted to the Air Force Civil Engineer Service Agency for publication in The Civil Engineer.

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REPORT DOCUMENTATION PAGE	*Form Approved* *OMB No. 0704-0188*

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
14-AUG-2009	Journal Article PREPRINT	01-AUG-2008 - 01-AUG-2009

4. TITLE AND SUBTITLE

Airfield Damage Repair - The Future Now (PREPRINT)

5a. CONTRACT NUMBER FA4819-07-D-0001

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER 62102F

6. AUTHOR(S)

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5d. PROJECT NUMBER 4915

5e. TASK NUMBER D1

5f. WORK UNIT NUMBER 4914D14E

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Deployed Base Systems Branch (AFRL/RXQD), 139 Barnes Drive, Suite 2, Tyndall Air Force Base, FL 32403-5323; US Army, ERDC
Applied Research Associates, Inc., P.O. Box 40128, Tyndall Air Force Base, FL 32403

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Air Force Research Laboratory
Materials and Manufacturing Directorate
139 Barnes Drive, Suite 2
Tyndall Air Force Base, FL 32403-5323

10. SPONSOR/MONITOR'S ACRONYM(S) AFRL/RXQD

11. SPONSOR/MONITOR'S REPORT NUMBER(S) AFRL-RX-TY-TP-2009-4560

12. DISTRIBUTION/AVAILABILITY STATEMENT

Distribution Statement A: Approved for public release; distribution unlimited.

13. SUPPLEMENTARY NOTES

Ref AFRL/RXQ Public Affairs Case # 09-132. Submitted to HQ AFCESA for publication in the Sep 2009 issue of The Civil Engineer.

14. ABSTRACT

The article will be published in the Air Force Civil Engineer Support Agency's magazine "The Civil Engineer", a quarterly publication. The article discusses the background for the Critical Runway Assessment and Repair (CRATR) Joint Capability Technology Demonstration (JCTD) from the technology perspective. It discusses the assessment, crater up heaval removal, and crater capping technologies, methods, and equipment.

15. SUBJECT TERMS

CRATR, JCTD, ADR, RRR, runway assessment, rapid setting, concrete, pellitized asphalt, expanding foam, back fill materials

16. SECURITY CLASSIFICATION OF: a. REPORT	b. ABSTRACT	c. THIS PAGE	17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
U	U	U	UU	5	R. Craig Mellerski
					19b. TELEPHONE NUMBER *(Include area code)*

Reset

Standard Form 298 (Rev. 8/98)
Prescribed by ANSI Std. Z39.18

The New Face of Rapid Airfield Repair

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Experience in Southwest Asia has shown that engineers responsible for airfield damage repair (ADR) need to focus on more than base recovery after attack or rapid runway repair. The full spectrum of ADR encompasses airfield maintenance, repair, and construction to support opening the base; establishing, expanding, or sustaining the mission; and rapidly recovering the airfield.

To identify key deficiencies in the current ADR practices and develop the ways and means to handle these various phases of ADR operations, the Air Force Civil Engineer Support Agency (AFCESA) at Tyndall AFB, Fla., established an ADR working group, bringing together experts from the Air Force, Army, Navy, and Marines in the United States, as well as allied nations. While the focus of this article is on recovery after attack, it should be noted that technologies were investigated, chosen, or developed with an eye on their potential use in other phases of ADR.

The group is working with AFCESA and DOD laboratories, such as the Air Force Research Laboratory (AFRL), Army Research Laboratory, the Army's Engineering Research and Development Center (ERDC), Navy Facilities Engineering Service Center, and Naval Air Systems Command, as well as field units to develop ADR equipment and techniques, tactics, and procedures (TTPs) to be delivered to units over the next five years.

Rapid airfield repair has been done the same way for years: get on the runway, find the holes, fix them using large, slow equipment, bolt down a huge, heavy mat over the repair, and pray that it lasts for a hundred sorties. If heavies and fighters have to land on the same repair you have a problem. The last real demonstration and testing of techniques that had any real impact on how we do business was SALTY DEMO in 1985.

The Air Force's preferred repair method is now a thin, folded fiberglass mat (FFM) or just crushed stone rather than AM-2 matting. AFRL has been leading the technology development for new materials and working on better ways to remove rubber, assess airfields, and anchor matting, as well as searching for AM-2's replacement. ERDC has improved fiber reinforced panels and anchor systems and integrated new runway construction methods, materials, and equipment. Industry continues to develop materials that are more stable, more predictable, and less sensitive to sub-optimal construction conditions, and smaller yet fast and powerful equipment with rapidly interchangeable attachments for versatility.

CRATR Opens Up New Capabilities

In January 2008, the Office of the Secretary of Defense directed the Air Force and U.S. Pacific Command to plan and execute a Joint Capability Technology Demonstration (JCTD) to address issues associated with rapid airfield repair. (JCTDs provide a means to improve turnaround time from operational problem identification to fielding of capability.) Called the Critical Runway Assessment and Repair, or CRATR, this ongoing JCTD will improve the capability of combatant commands to recover air operations during periods of conflict.

The objectives of the CRATR JCTD are to demonstrate and transition to the joint warfighter a capability to rapidly 1) assess airfield damage and select a minimum airfield operating strip (MAOS), and 2) repair numerous small craters to support both fighter and heavy aircraft traffic for days rather than hours

CRATR only addresses the rapid airfield repair tasks of damage assessment, locating unexploded ordnance (UXO), MAOS selection, and crater repair; it does not address UXO clearing, MAOS sweeping and marking, or airfield arresting system and lighting installation.

Airfield Assessment is currently done by a five-member airfield damage and assessment team in a vehicle on the airfield, which puts them in harm's way. Multiple teams are needed for large installations or fast (< two hours) repairs. The CRATR JCTD is demonstrating technologies that take Airmen off the airfield during the assessment phase and speed up MAOS selection. By using remote sensors on the Rapid Airfield Damage Assessment System that identify craters, spalls, and UXO and plot the information onto a digital map of the runway, the MAOS can be selected in less than 45 minutes.

After the MAOS is selected and UXO cleared, crater repair begins, a process that includes seven essential steps: debris clearing, crater marking, cutting, upheaval removal, backfilling and capping, material curing/cooling.

The initial debris clearing is essential for rapid crater marking and convoy movement. Some current equipment will still be used, but newer smaller, faster, and more maneuverable models will be employed in and around the craters. One key piece of equipment is a multi-terrain loader (MTL) with a bucket attachment. Its ability to move quickly and turn 180 degrees on a dime significantly reduces debris removal time.

The MTL has an equal or more important role in removing the upheaval. After the upheaval is identified and marked, an MTL with a wheel saw (rock saw) can quickly cut through 18" of concrete, leaving clean edges for quicker and better (more uniform and longer lasting) repairs. After a wheeled excavator with quick-connect hydraulic attachments removes the pavement, the MTL with the bucket takes it away.

Several options for backfilling the crater are being compared as part of the JCTD. Crushed stone is still the cheapest and can usually be placed pretty quickly, and the MTL has a great steel vibratory roller that can get down into the crater. However, when compared to newer materials and methods, placing crushed stone is slow and strenuous. ERDC has been researching quick-setting flowable fill, a controlled low-strength concrete that is a mixture of rapid-setting cement and sand. ERDC has also developed a high-density foam that, when capped with nine inches of rapid-set concrete, will support a fully loaded C-17. The foam expands up to eight times its original volume and can fill even the largest craters in a few minutes. All of these methods have been researched and tested and have demonstrated sufficient strength to hold the crater cap and a fully loaded C-17 or F-15E.

Capping the crater requires a flush repair and new repairs must last at least a week (thousands of sorties) without failure or major maintenance effort with all types of aircraft traffic. To meet these requirements, two capping materials have been developed and tested, one consisting of hot mix asphalt (HMA) and the other of rapid-setting concrete. AFRL has led the development of pelletized asphalt for HMA. Pelletized asphalt can be stored in super sacks and mixed 1:1 with large aggregates in a batch plant to produce airfield quality asphalt; a mobile asphalt recycler can produce about five tons of HMA every 30 minutes. When paired with the rapid setting flowable fill this becomes a formidable repair technique.

ERDC has also been developing rapid-setting cement technologies for capping, and has partnered with industry to develop a simplified volumetric mixer. A prime advantage of pairing rapid-setting cement materials with a volumetric mixer are that the cap requires no vibration and minimal handwork and finishing. The material has little to no slump and is ready for traffic in about two hours.

The CRATR JCTD has had three demonstrations (August 2008, April 2009, and August 2009), during which all of the repair materials, equipment, and methods have been employed by Airmen to create repairs that have successfully supported thousand of passes of load carts used to simulate the traffic loads of F-15 and C-17 aircraft. The last demonstration for the rapid airfield damage assessment portion of the JCTD is anticipated for early CY10.

Once all the final results have been coordinated, evaluated, and sanctioned, what has been described in this article will be incorporated in a new concept of operations and new/updated equipment sets, for which funding has been set aside. Within the next five years these materials, equipment, and TTPs will be a part of the new ADR capability.

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